

# CHM 116: Principles of Chemistry II

**Course Description:** The second semester in the two semester General Chemistry Program for Science Majors.

**Inquiry:** A three-week inquiry lab in CHM 116 is designed to promote critical thinking about unknown ion identification via separation schemes.

**Prerequisites:**

CHM 115

MTH 122 (College Algebra)

**Text: Required:** Chemistry; Chang, R. McGraw Hill. New York, 7th edition.

**Instruction Methods :**

Lecture (4 fifty minute lectures/week)

Discussion (1 fifty minute discussion session/week)

Lab (1 three hour lab/week)

Web Site (used for homework, handouts, course information, and student/faculty communication.)

**Course Web Site:** The web-site will be used by all students for a portion of the course. All homework sets are in an on-line format and must be submitted through the web-site. The web-site also contains other student tools (answer sheets, discussion worksheets, etc.) and resources which will be needed throughout the semester.

**Calculators:** You will need a battery or solar powered scientific calculator, capable of scientific notation, "log" and "inverse log" calculations, for the exams. Each student must have their own calculator since they may not be shared during an exam. Students may not use a calculator which is capable of storing text on any exam.

**Classroom Courtesy:** Large lecture sections raise unique issues of mutual courtesy. In this setting we must all give up a little so that each student has the best chance to hear and learn without distraction.

Turn off all audible cell phones and pagers. A silent or vibrating type is fine, but no sound please. Take all calls in the hall.

Class starts and stops on time I will always start on time and will do my best to never run overtime. Try your best to be on time so that your entrance doesn't disturb others. Since I agree to stop on time or a minute or two early, **refrain** from starting to pack up your books during the closing summary of the lecture. Key points are often being made and it is hard for others to hear.

Don't Chat in Class Sometimes you miss a point and need to ask your friend. Do so quietly or even better, ask me to clarify (I actually don't mind). Other than that, refrain from talking in class. Too much chat and you will be asked to leave.

These courtesy issues are here to insure that you have full access to the information. If you don't care about yourself, please at least be courteous to others.

**Discussion Period:** You are required to attend one of the discussion sections handled by your instructor (Sections A1, A2, A3, A4). During these weekly sessions, topics that are central to those weeks' lectures will be analyzed and discussed. This discussion will include a forum for you to ask questions you may have from the homework assignment, the laboratory work or the lectures. Since it is a discussion, you will be expected to participate. Each week in discussion section, there will be a problem or worksheet to be completed in class by you or with a group. This will be turned in for credit at the end of that discussion period.

**Quizzes:** Approximately 1 week before each test, a quiz will be given in discussion section as a way to assess your understanding of the material. These will consist of several questions and will have an approximate 20-minute time limit. There are no make-up quizzes. The credit for discussion worksheets and quizzes will make up 8% of your grade. I hope it is clear that you cannot afford to skip discussion.

The formation and maintenance of study groups is strongly encouraged. If you wish, you may register a formal study group with the instructor. Once registered you will receive access to a chat room and a bulletin board for the exclusive use of your group members.

**Problem Assignments:** The ability to master the material is best achieved by working a series of mathematical and conceptual problems. Each week you will receive a series of short problem sets on the course website. These problems contain random number generators or are drawn from a large database of questions so that many times each student has a unique set. These must be completed and the answers submitted on-line prior to the posted deadline. These will be immediately graded by computer so that you know your score. You may retake a problem set as many times as you wish and your grade will be recorded for your most recent submission. You may not get the same problems each time you retake the set. Your homework score will be the last submitted problem set of the week. Homework will comprise 8% of your grade. Since you can resubmit your answers until you get the correct answers it is very possible to get a full 8% for this section of your grade.

**Laboratory Requirements:** Laboratory experience is a requirement for credit in this course. There will be 14 lab experiments, one each week, with a report required for each one. If you are repeating the course, you repeat the lab, no exceptions.

1. There are two types of labs that will be taught: an inquiry style lab (written lab reports) and a standard verification style lab (fill in the data sheets).
2. Reports for the Inquiry style labs are due at the start of the next lab period. As soon as the lab starts, labs turned in will be considered late. Labs that are turned in late will be penalized 10% points for each day late. Any lab turned in after the start of the next lab period will not be accepted.
3. No one may leave the inquiry style labs early, unless your instructor says it is okay. At the very least though you should discuss all the questions at the end of the lab with all of your lab partners. This does not mean dividing the questions in half and copying the half you did not do.
4. Reports for the remaining labs are due before you leave the lab.
5. Each week you must pre-read the lab so that you can do well on the pre-lab quiz. This advance preparation will make each of the labs flow more smoothly, go more quickly, and allow you to make more connections to support the concept being taught in class.

In order to pass the entire course, you must pass the lab with better than a 60% average.

You must attend the lab session in order to receive any credit. There are no make-up labs. If you miss a lab you must fill out a laboratory absence form (found in the lab manual). The first absence will be taken on the student's word. Any additional absence will be counted as a zero unless written verification of the reason is obtained and deemed acceptable by the instructor. A total of three missed labs will result in failure of the lab section and therefore the course.

Each student who enrolls in a lab course pays a laboratory fee. This fee covers the cost of chemicals, non-reusable equipment, and a nominal amount of breakage for each student. Individual students will be billed for any excessive breakage.

**Exams:** Lecture hour exams are used to evaluate the student's progress and will determine a large portion of the student's grade. Exams will be graded and returned to the student as a study tool as quickly as possible. The final exam, however, will not be returned to the student. Books, papers and notes of any kind are prohibited during exams. If a student is caught cheating, the student will fail the course and potentially face expulsion.

Exams will consist of two parts: The first and larger portion will be a basic skills section where you will be quizzed on your command of important definitions, theory, and the straightforward use of key algorithms. The second part of the exam will test the development of your problem solving skills in a scientific setting. It will require you to use combinations of your base knowledge to solve original problems.

There will be no make-up exams (no exceptions). If a student is unable to attend an exam, the points from that exam will be used to increase the weight of the comprehensive final.

**Course Grade** is determined by the weighted average of the following components. If the student takes all 4 tests then:

Exams (4) 58%

Lab Average 14%

Final Exam 12%

Homework Average 8%

Discussion and Quiz Average (~4 of them) 8%

If the student misses one exam then:

Exams (3) 50%

Lab Average 14%

Final Exam 20%

Homework Average 8%

Discussion and Quiz Average (~ 4 of them) 8%

If the student misses more than one exam, each additional absence will be assigned a percentage score of zero. (Hint: don't miss the tests!)

**Grading Scale:** Grading will be based on the following scale:

A = 90+; A- = 87-89; B+ = 84-86; B = 80-83; B- = 77-79; C+ = 74-76; C = 70-73; C- = 67-69; D+ = 64-66; D = 60-63; F = < 60

**Incompletes:** The grade "I" is sometimes granted when a student is temporarily unable to complete course requirements because of unusual circumstances. It may be assigned when illness, necessary absence, or other reasons generally beyond the control of the student, prevents completion of the course requirements by the end of the semester. This grade may not be given as a substitute for a failing grade or withdraw.

The "I" grade will not be assigned for incomplete course work, which was due before the twelfth week of the semester. A request for an "I" grade must be made in writing before the final exam. To make this request you must schedule an interview with the instructor.

**Exam Schedule:**

Exam 1: Monday, Sept. 27

Exam 2: Monday, October 25

Exam 3: Monday, November 15

Exam 4: Monday, December 8

Final Exam: Wednesday, December 15 (2 pm to 3:50 pm)

**Course Goals**Goals Specific to This Course

- 1) Provide a clear understanding of the fundamental principles of chemistry from a molecular/theoretical perspective.
- 2) Explain basic chemical reactivity using current theories of thermodynamics via equilibrium and kinetics concepts.
- 3) Provide the student with the relevance of chemistry to their daily lives.
- 4) Stress the interconnections between the various topics so that students can see how the major themes of Equilibrium, Thermodynamics (Energy), Stoichiometry, and Chemical Bonding, run throughout the material.

General Education Category Purpose and Description

The physical sciences explore and seek to explain the behavior of the physical universe. They seek to understand the fundamental workings of nature, from the behavior of particles of matter to the functioning of the galaxies. Study of the concepts, history, contexts, and methodologies of the physical sciences assists students in becoming scientifically literate. Each course in this category is a broad introduction to one or more of the physical sciences. Courses contribute to the development of critical thinking and problem-solving skills, and help students apply an understanding of scientific ways of thinking to their own lives and careers.

Content Objectives

All courses in the Physical Sciences Category include the following content:

- 1) The introduction of the physical sciences as a "way of knowing"; an examination of principles and questions that define the field;
- 2) An understanding of how scientists use information and theory to explain the phenomena observed in the physical universe;
- 3) The unifying concepts of the physical sciences including the forces of nature, the structure of materials, and the role of energy in the physical universe.

Skills Objectives

All courses in the Physical Sciences Category use teaching methods that help students become more proficient in the following skills:

- 1) To engage in articulate expression through effective speaking or writing;
- 2) To think critically and creatively;
- 3) To locate, evaluate, and use information effectively.

<b><u>Week of</u></b>	<b><u>Topics (chapter.section)</u></b>
Aug. 30	Introduction into Equilibrium (16.all)
Sept. 6	Equilibrium and Energy, Equilibrium and Kinetics (16.all, 18.3)
13	Chemical Equilibrium (16.all)
20	Chem. Equilibrium, Strong Acids and Bases (15.1-15.4)
27	EXAM 1, Titrations and Weak Acids (15.4-15.6)
Oct. 4	Polyprotic Acids, Buffers (15.6 – 15.9, 16.1 – 16.4)
11	Buffers, Solubility (16.1 – 16.6)
18	Solubility (16.6 – 16.11)
25	EXAM 2, Transition Metals (22.all)
Nov. 1	Chemical Kinetics and Energy (13.5, 13.1)
8	Chem. Kinetics (13.all)
15	EXAM 3, Thermodynamics (18.all)
22	Thermodynamics, Thanksgiving Vacation
29	Electrochemistry (19.1 –19.2)
Dec. 6	Electrochemistry (19.2 –19.5), Exam 4
15	Final Exam (2:00 – 3:50) Comprehensive Final

\* Energy will be the path upon which all topics for this course are linked.

### **Lab Syllabus**

<b><u>Week of</u></b>	<b><u>Lab Title</u></b>
1	Solution Preparation
2	Equilibrium Behavior of Cobalt Complex Ions
3	Chemical Equilibrium
4	K <sub>sp</sub> of Calcium Iodate
5	pH and Conductivity
6	Strong Acid-Strong Base Titration
7	Determination of pK <sub>a</sub> and pK <sub>b</sub> using Acid-Base Titrations
8	Buffers
9	Equilibrium and Thermodynamic Study of Borax

10	Shifty Equilibria I, A1-A4
11	Shifty Equilibria II, B and C1
12	Shifty Equilibria III, C2
13	Kinetics of the Reaction of $\text{H}_2\text{O}_2$ and Iodide
14	Lab Practical